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GROWTH OF THE SHRIMP, *PENAEUS AZTECUS*, FED A DIET OF LIVE MYSIDS (CRUSTACEA: MYSIDACEA)

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ABSTRACT Commercial brown shrimp (*Penaeus aztecus*) were shown to consume large numbers of mysid shrimp (*Mysidopsis almyra*) under laboratory conditions. Growth of shrimp fed a diet of mysids was comparable to growth of shrimp fed a diet of *Artemia* nauplii. It is suggested that mysid shrimp may serve as a food source for juvenile penaeid shrimp in northwestern Gulf coast estuaries.

INTRODUCTION

The rapid growth of juvenile brown shrimp (*Penaeus aztecus*) along with their nutritional value and high demand has led to their consideration for mariculture. The artificial foods that have been formulated and tested in the laboratory generally result in growth for juvenile shrimp that is less than that for shrimp fed natural food (Zein-Eldin and Meyers 1973). *Artemia* are generally used as a subsistence or control diet but are not naturally available to shrimp in the estuary. It is suggested that some other crustacean may serve as the major food source for natural populations of shrimp. Because mysid shrimp can be collected along with penaeid postlarvae (Christmas et al. 1966) in large numbers in the shallow estuarine areas during summer months (Conte and Parker 1971), and are known to have a high caloric value (Wissing et al. 1973), they were evaluated in this study as a food for shrimp.

MATERIALS AND METHODS

Four experiments were conducted over the period of August 1973 to June 1974. Experiments were conducted using a variety of glass containers having no substrate and no filtration. Aeration was provided through a single air stone in each container. Brown shrimp were obtained from the hatchery of the National Marine Fisheries Service in Galveston through the courtesy of Mr. C. Mock. They were held a maximum of 1 week in 150-liter aquaria with sub-gravel filters and fed a commercial flake food (Tetramarin[2]). One liter of artificial sea water (Instant Ocean[2]) per shrimp was provided at 20 ppt and room temperature (ca. 23°C). Illumination from a 40-watt fluorescent lamp was controlled by a timer to give a photoperiod of 14 hours light per day. Mysids (*Mysidopsis almyra*) were collected alive from the marshes of Galveston Island as required and held in a 150-liter aquarium with filtration.

In a preliminary experiment, mysid consumption by three sizes of shrimp was tested (Table 1). Shrimp were placed in separate 1-liter aquaria and each size was replicated. Each aquarium was provided with five mysids. Aquaria were examined every 4 hours for a period of 5 days. The number of mysids consumed was recorded and additional mysids provided to maintain a density of five per aquarium. The average wet weight of a mysid (0.0011 g), based upon 100 determinations, was used to determine the weight of mysids consumed by the shrimp (Table 1).

Due to the difficulty in supplying a sufficient number of mysids for large (60 mm) shrimp, under these experimental conditions and the unavailability of postlarval shrimp, penaeids approximately 30 mm in size were used for growth experiments. In three experiments shrimp were fed an abundance of mysids or *Artemia* nauplii once daily. In an additional aquarium shrimp were not fed. Detritus was siphoned out every other day but the water was not changed during an experiment. Length (tip of rostrum to end of telson) was determined to the nearest mm utilizing Allen's (1963) procedure at the initiation and the termination for individual shrimp in experiment A (Table 2). To avoid handling the shrimp in subsequent experiments (B and C Table 2) length was determined by sacrificing an initial sample and all survivors. In experiment A increase in size of individual shrimp held in 1-liter fingerbowls was determined after 5 days. In experiment B an initial 30 shrimp were placed in each of three 115-liter aquaria. Water was removed from each aquarium to maintain 1 liter per shrimp. Every 5 days for 15 days, 10 shrimp were removed and sacrificed. An attempt was made to capture the smallest and largest shrimp according to the procedure of Zein-Eldin (1963). Five-liter aquaria were used in experiment C to determine increase in size of individual shrimp after 21 days.

RESULTS AND DISCUSSION

The maximum growth rates for *Artemia*-fed shrimp (0.82 mm per day) and for mysid-fed shrimp (0.72 mm per day) were comparable. In one experiment (A, Table 2) the mysid-fed shrimp had a faster growth rate than the *Artemia*-fed shrimp. The lesser growth rate for the mysid-fed shrimp in experiment B (Table 2) possibly was due to the larger area of the aquarium, compared with the fingerbowl, which

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[2] Use of trade names does not imply endorsement.

TABLE 1.

Maximum consumption of mysids by *Penaeus aztecus* over 5 days.

Shrimp Size	Number Consumed	Weight Consumed	Final Weight of Shrimp (g)	Shrimp Weight Consumed (%)	Daily Consumption (%)
10 mm postlarvae	8	0.0088	0.004	220.0	44.0
10 mm postlarvae	14	0.0154	0.010	154.0	30.8
30 mm	65	0.0715	0.26	27.5	5.5
30 mm	60	0.0660	0.28	23.6	4.7
60 mm	109	0.1199	1.24	9.6	1.9
60 mm	95	0.1045	1.07	9.7	1.9

TABLE 2.

Daily growth rate in length (mm per day) of *Penaeus aztecus*.

Diet	Growth Rate (mm/day)	Range in Final Size	No. Shrimp
Experiment A – 5 days in 1-L. fingerbowl			
Unfed	0.08	(32–42)	9
Artemia-fed	0.52	(33–43)	8
Mysid-fed	0.72	(35–45)	7
Experiment B 1st Sample – 5 days in 115-L. aquaria			
Unfed	0.06	(22–32)	10
Artemia-fed	0.46	(24–35)	10
Mysid-fed	0.42	(26–33)	10
2nd Sample – 10 days in 115-L. aquaria			
Unfed	0.13	(25–32)	5
Artemia-fed	0.82	(27–40)	10
Mysid-fed	0.25	(25–35)	10
3rd Sample – 15 days in 115-L. aquaria			
Unfed	–	–	0
Artemia-fed	0.82	(32–44)	10
Mysid-fed	0.35	(27–42)	6
Experiment C – 21 days in 5-L. aquaria			
Unfed	–	–	0
Artemia-fed	0.40	(32–37)	2
Mysid-fed	0.33	(32–34)	2

Avg. daily growth: Unfed–0.09; *Artemia*-fed–0.60; Mysid-fed–0.41.

provided the mysids a greater area in which to evade the shrimp. *Artemia* provided in the other aquarium tended to remain aggregated, thus being more vulnerable to predation. However, in the 5-liter aquaria (experiment C, Table 2) growth of *Artemia*-fed shrimp was poor and the shrimp fed with mysids grew less rapidly than the *Artemia*-fed shrimp.

No unfed shrimp survived longer than 14 days. None of the fed shrimp died during the experiments. Losses occurred due to shrimp jumping out of aquaria during feeding or observation.

Growth in these studies at no time approached the growth rate of 1.5 mm per day reported for brown shrimp in the natural environment (Williams 1955). Growth of shrimp in aquaria is usually less than that expected from nature. Zein-Eldin (1963) using 0.41 liters of water per shrimp and feeding *Artemia* achieved a maximum growth of 0.42 and 0.68 mm per day. Zein-Eldin and Aldrich (1965) achieved a maximum growth rate of 1.11 mm per day on a diet of *Artemia*. The average of the growth rates from the three experiments for *Artemia*-fed (0.60 mm per day) and mysid-fed (0.41 mm per day) shrimp is comparable to the growth rate (0.42 mm per day) reported by Zein-Eldin (1963). By maintaining better water quality and feeding a mixed diet, better growth possibly could be obtained in the laboratory.

While growth in this study did not approach that reported from nature, the growth of mysid-fed shrimp was comparable to that of *Artemia*-fed shrimp. Considering that mysids occur with shrimp in large numbers when the shrimp postlarvae are entering the estuaries, it is suggested that mysid shrimp may serve as a food source for juvenile penaeid shrimp.

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